CURRENT LITERATURE.

BOOK REVIEWS.

Plant physiology.

PROFESSOR G. J. PEIRCE, of Stanford University, has elaborated lectures upon plant physiology which he has been giving in the University into a text-book,[1] less extensive than Pfeffer's treatise, and more full than Noll's treatment in the Bonn text-book. This is published in attractive form and will be found of interest both to the general reader and to students. The book differs from the *Text-book of plant physiology* by MacDougal, in that there are no laboratory directions, the author believing that the laboratory manual and the text should be divorced. The only English work with which the book at all competes is the *Vegetable physiology* of Professor J. Reynolds Green.

Peirce's book shows strongly the impress of Pfeffer's *Physiology*, and to him the author makes ample acknowledgment. One who reads the book carefully will be impressed by the clearness of style and the vigor of presentation, as well as by the freshness of much of the matter and the modern point of view from which the author regards his subject. The book is characterized by two features: first, an endeavor to state the phenomena of plant life in the terms of physics and chemistry; and, second, by the clear recognition of the fact that very many plant phenomena cannot yet be adequately stated in these terms, and the consequent acknowledgment that they are at present not sufficiently known. This makes the book stimulating to the student, for many lines along which research will be profitable are pointed out to him. In many ways the book is a decided advance upon any English text which has come to our notice.

After recognizing fully the value of this work, its originality, its vigor, its clearness, its stimulating statements of the incompleteness in our knowledge, and its probable marked usefulness as a text-book in colleges and schools, there remains the less pleasant task of pointing out some of its shortcomings.

After an introductory chapter, the first topic is respiration, and here we think the author has adopted an unfortunate theory which does not agree with the observed phenomena. The whole treatment is based upon the theory that foods of various kinds are directly oxidized to furnish energy. This is plainly derived from Pfeffer, and of course should be stated as a theory; but the other view of respiration, which, in our judgment, is much more probable because in closer harmony with the facts, is not even mentioned.

In the chapter on nutrition which follows, there is no adequate treatment

[1] PEIRCE, GEORGE JAMES, A text-book of plant physiology, 8vo. pp. vi + 291, *figs. 22*. New York: Henry Holt and Company. 1903. $2.00.

of the mode of absorption of gases, which is repeatedly spoken of as though it were merely their diffusion from the external air into the intercellular spaces.

We are glad that Professor Peirce adopts the view that the food of all plants consists of complex carbon compounds; but he does not always in his terminology distinguish between foods and the materials out of which green plants may construct foods. Assimilation is very properly distinguished from photosynthesis. The treatment of the latter might have been somewhat extended with profit. It would have been especially desirable to include some notice of the work of Friedel (1901) on extracellular photosynthesis, especially as that work was confirmed in the autumn of 1902 by Macchiati.

It would seem that the chapter on absorption and movement of water might have been advantageously placed at the beginning of the book, since such processes are fundamental to an understanding of respiration or nutrition. The discussion of absorption, transfer, secretion, etc., are in the main clear and in accordance with modern physical notions, though there are some slips that should be corrected in later editions, such as the definition of osmotic pressure. In the treatment of transpiration and the movement of gases, however, the author has not freed himself from older and untenable ideas. This is well illustrated by the sentence: "It may easily happen in temperate regions that the plant takes in more water and more salts than it really needs, and that while the former evaporates, the latter accumulate in useless forms and quantities, with or without chemical change." Similarly, the account of gas exchanges in the intercellular spaces is open to serious criticism.

We fear that readers will be somewhat puzzled in the chapter on growth by such contradictory statements as these: "Growth is a process dependent upon the formation of new protoplasm" (p. 165); "The second stage in growth . . . . consists mainly, if not wholly, in the absorption of water" (p. 167). On page 166 we have the formation of new protoplasm and new cells described as "the first and *fundamental* stage in the process of growth;" while on page 174 we are told, "Cell division . . . . does not constitute an essential part of the process of growth."

The treatment of the subject of irritability is distinctly novel and interesting. For the student, however, it lacks a logical presentation of the phenomena of irritability which are common to all its manifestations. The chapter on reproduction, which in many physiological books is merely an account of the morphological phenomena, is noteworthy in being almost purely physiological, and it makes very obvious how little we yet know about the physiology of reproduction. In this connection the author lays more stress upon the results of Klebs than future study is likely to justify, since Klebs omitted all consideration of the effects of osmotic pressure in the solutions with which he was working. It is not unlikely, therefore, that his conclusions will be profoundly modified when this factor is taken into account. Certainly the work of Livingston, Greeley, and others, points strongly in this direction.

That the topic digestion is nowhere treated is certainly a noteworthy omis-

sion. Only as an incident in the chapter on nutrition is it mentioned that foods temporarily stored in the chloroplasts must be transformed before removal, and implications of the same kind occur in connection with the general subject of the transfer of foods. But nowhere is there any discussion of the important part which digestion plays in plant life, nor any account of the agents by which it is accomplished.

It would not be difficult to point out minor inaccuracies here and there in Professor Peirce's book, nor unfortunate modes of expression; an illustration of the latter, and one very common in physiological writings, is repeated many times when he speaks of natural "laws" as though they were objective and efficient agents.

Professor Peirce's book contains so many excellent features that it is unfortunate to have it marred somewhat by sins of omission and commission. But all these matters may be rectified in future editions without fundamentally changing the character of the book, which will be useful to students, particularly if they have access to other books; and nowadays no student ought to get his physiological information from one source.—C. R. B.

Diffusion and osmotic pressure.

The rôle of diffusion and osmotic pressure in plants, by Dr. Livingston, is a well-made and attractive-looking volume of 149 pages, constituting one of the Decennial Publications of the University of Chicago.[2]

For several years the need of a concise, yet sufficiently detailed, statement of the facts and modern theories of diffusion and osmosis, on both the physical and the physiological side, has been felt by every student and teacher of physiology. Such a volume has now appeared.

Dr. Livingston has divided his book into two parts, one dealing with physical and the other with physiological considerations. In the first part we have Matter and its states, Diffusion and diffusion tension, Liquid solutions, Ionization, Osmotic phenomena, Measurement and calculation of osmotic pressure; and in the second part Turgidity, Absorption and transmission of water, Absorption and transmission of solutes, Influence of the osmotic pressure of the surrounding medium upon organisms.

After stating briefly the theories of matter, the author proceeds to the consideration of the diffusion of gases, liquids, and solids, and then in the following chapter discusses in a lucid manner the difficult subject of solutions, using this opportunity to repeat and apply the teachings of the preceding chapter on diffusion, and showing his regard for the needs of the student by defining such terms as *normal solution*, *gram-molecule solution*, and *gram-equivalent* solution.

[2] LIVINGSTON, BURTON E., The rôle of diffusion and osmotic pressure in plants. Decennial Publications of the University of Chicago, Second Series, Vol. VIII. 8vo. pp. xvi + 149. University of Chicago Press. 1903. $1.50.